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IMPACT OF VARIOUS COMBINATIONS OF MICRONUTRIENTS ON THE CHEMICAL COMPOSITION OF SEEDS OF THREE CULTIVARS OF *CICER ARIETINUM* L

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ABSTRACT

Chickpea is a leguminous crop which has health benefits to humans as it has a high content of proteins, carbohydrates, lipids, fibers, and minerals. The study was conducted to identify the effect of some suitable combination of micronutrients (Cu, Zn, Fe, Mn and B) in-take and crude protein, total nitrogen and carbohydrates on the chemical composition of grains of three varieties of Cicer arietinum L. (gram) viz. BG-256, K-850, and PG-114. The various combinations of trace elements were supplied in form of an aqueous solution in the soil as ppm @ 1 litre/pot maintained in three replicates for each treatment. In this study, the combinations of various micronutrients were used on different cultivars of chickpea viz. BG-256, K-850 and PG-114 may enhance the metabolic concentration and elemental bioaccumulation in the seeds without causing any toxicity.

KEYWORDS: Nitrogen, Micronutrients, Cicer arietinum L. & Trace Elements

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INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the fourth largest grain legume crop in the world, with a total production of 10.9 million tons from an area of 12.0 million ha and a productivity of 0.91 ton/ha. Major producing countries include India, Pakistan and Iran (Yearbook, 2010). About 90% of chickpea in the world is grown under rain fed conditions where drought is one of the major constraints limiting its production. Drought affects various morphological and physiological processes, resulting in reduced growth, development and economic yield of crops. Water stress has a prominent effect on leaf number, total leaf area and secondary branches causing invariable reduction under rainfed conditions (Basu *et al.,* 2007). The major characters affecting crop grain yield are number of pods and seeds per plant which reduce under drought stress (Davies *et al.,* 2000).

Different sources of nitrogenous fertilizers have been recommended for several crops. However, dose, age, time, and mode of application vary for each crop (Paisley, 1960). Several cultivars of chickpea have been worked by agriculturists, geneticists and plants physiologist in recent years. Effect on the N and P uptake by chickpea is influenced by micronutrients and biofertilizers (Gangwar and Dubey, 2012). A comparison of effects of micronutrients of seed priming and soil fertilization on chickpea was done by Sarah *et al.*, 2005. Effect of biofertilizers and micronutrients on yield of chickpea is quoted by Nirmala *et al.*, 2019. The application of micronutrients through seed treatment was conducted by Farooq *et al.*, 2012. However, the information pertaining to the effect of different inorganic and organic sources of nitrogen, crude protein, carbohydrates and ether extract on different cultivars of *C. arietinum* L. is meager. This paper embodies the results of the study conducted to find out

the effect of different sources of nitrogen on these attributes in three cultivars of *C. arietinum* L. *viz.* BG-256, K-850 and PG-114.

MATERIAL & METHODS

Seedlings of three cultivars of *Cicer arietinum* L. were obtained from Govt. Agricultural Research Farm, Bilwa, Bareilly. Seedlings were sown separately in polythene lined earthen pots (diameter 32.0 cm, unit Area 0.075m2) filled with garden soil (sand 51%, Silt 36%, Clay 13%, pH=7.5). Three seedlings were transplanted per pot filled with soil containing available N, P and K @ 162.2, 32.7 and 210.6 Kg/ha respectively.

The following treatments were given: (1) No fertilizer (control), (2) CuSO4 (T1), (3) ZnSO4 (T2), (4) MnSO4 (T3), (5) Na2B4O7 (T4) and (6) FeSO4 (T5).

Irrigational treatments were allocated by supplying chemical fertilizers in the form of fortnightly intervals to each of the three replicate pots maintained for each treatment. The crop was harvested at fruit maturity. Total nitrogen, crude protein and ether extract contents of seeds of each cultivar were determined by % dry matter basis according to Piper method (1966). Data was analyzed statistically according to Snedecor and Cocchran method (1967). Mean of three values ± SE Variance ratio CD at 5% and SEM ± were recorded.

RESULTS & DISCUSSIONS

The data revealed that total carbohydrates content in the seeds of all the three cultivars of chickpea decreased significantly ($P \leq 0.001$) in treatments comprising a mixture of Cu + Fe and Fe + Zn applied as basal dose and Cu + Fe + Zn + Mn + B applied as foliar dose over their control, while the same was significantly higher in treatment with a combination of Zn + Mn and Cu + B. percentage increase over control, was maximum in the variety K-850 followed by PG-114 and BG-256.

Table 1: The Total Nitrogen, Crude Protein and ether Extract Contents of *Cicer arietinum* L. as Affected by Different Sources of Nitrogenous Fertilizers on its Three Varieties (% on Dry Matter Basis).

Variety	Treatments							
	Control	**T1**	**T2**	**T3**	**T4**	**T5**	**CD at 5%**	**SEM ±**
Total Nitrogen BG-256 K-850 PG-114 CD at 5% SEM±	5.221±0.13 6.397±0.18 5.497±0.13 0.537 0.090	6.39±0.23 (+1.169) 7.148±0.04 (+11.73) 6.374±0.01 (+15.95) 0.3 0.050	7.403±0.07 (+41.79) 7.388±0.08 (+15.49) 6.921±0.04 (+25.90) 0.246 0.041	4.334±0.12 (-16.98) 6.418±0.07 (-15.30) 4.578±0.11 (-16.71) 0.376 0.063	4.125±0.08 (-20.99) 3.445±0.07 (-46.14) 4.454±0.09 (-18.97) 0.347 0.058	6.275±0.08 (+20.10) 6.544±0.09 (-2.29) 6.829±0.08 (-24.23) 0.377 0.063	0.299 0.324 0.329 — —	0.04 0.043 0.044 — —
Crude Protein BG-256 K-850 PG-114 CD at 5% SEM±	32.631±0.81 39.981±1.19 34.356±0.85 3.359 0.560	39.937±0.52 (+22.30) 44.675±0.40 (+11.74) 39.835±0.68 (+11.79) 1.881 0.314	46.268±0.47 (+41.77) 46.175±0.50 (+15.47) 43.256±0.37 (+25.91) 1.539 0.257	27.087±0.72 (-17.00) 40.112±0.41 (-15.29) 28.612±0.76 (-16.70) 2.351 0.392	25.781±0.50 (-21.05) 21.531±0.40 (-42.56) 27.837±0.60 (-18.97) 1.771 0.295	39.218±0.55 (+20.17) 40.9±0.15 (-0.802) 42.681±0.61 (-24.23) 1.66 0.277	1.873 1.907 2.054 — —	0.248 0.253 0.272 — —

Carbohydrate								
BG-256	2.036±0.04	2.296±0.04 (N.S.)	3.971±0.04 (+95.03)	2.581±0.07 (+26.76)	2.039±0.05 (N.S.)	3.257±0.09 (+59.97)	0.182	0.024
K-850	2.301±0.04	2.609±0.04 (+13.38)	3.553±0.07 (+54.41)	2.724±0.01 (+18.38)	2.377±0.07 (N.S.)	3.56±0.07 54.71	0.191	0.025
PG-114	2.507±0.04	2.563±0.04 (N.S.)	3.429±0.30 (+36.77)	2.551±0.05 (N.S.)	2.287±0.26 (N.S.)	3.58±0.12	0.373	0.049
CD at 5%	0.017	0.017	0.019	0.043	0.037	0.082	—	—
Values in parenthesis denote % increase over control N.S.= Not Significant								

The total sugar content exhibited a significant increase over control in all the combinations of micronutrients used, being maximum in Cu + B treatment. The percent increase over control was in order BG-256 < PG-114 < K-850. Reducing sugar content was maximum in var. PG-114 followed by K-850 and BG-256, and the percentage increase for non-reducing sugars was in the sequence- PG-114 < BG-256 < K-850.

Calcium content increased significantly higher in all treatments in each variety, being maximum in all varieties receiving a mixed dose of Cu + Fe + Zn + Mn + B applied as foliar spray. The percent increased over control was maximum in var. K-850 followed by BG-256 and PG-114. The percent increase for P was maximum in var. K-850 followed by BG-256 and PG-114.

Potassium content exhibited by varieties in the sequence- BG-256 < K-850 < PG-114, supplied with Cu, Fe, Zn, Mn and B as the combined dose given as foliar spray. The percent of Na was maximum in var. BG-256 followed by K-850 and PG-114.

Copper content was in the order of BG-256 < PG-114 < K-850. The percent of iron was maximum in PG-114 followed by BG-256 and K-850. The percent of Mn was better in var. K-850 and PG-114 whereas, maximum in var. BG-256.

Zinc content was maximum in var. BG-256 while the same decreased in K-850 and PG-114. On the other hand lipid content was also detected maximum in var. K-850 and PG-114, which received Cu, Fe, Zn, Mn, and B as foliar spray, while the same was maximum too in var. BG-256 by application of Fe + Zn given as basal dose.

Ether extract content decreased ($P < 0.001$) from treatment T1 to T5 (Table-1) while, the utmost decline was recorded in T5. Nitrogen and protein content of three cultivars of chickpea seeds as affected by the combination of trace elements application. The percent increase was maximum with application of Fe + Zn. The value was 41.77, 25.91 and 15.47% in var. BG-256, PG-114 and K-850 respectively. Almost similar findings have been reported by Agarwala (1979).

All three cultivars behaved differently in different treatments with respect to crude protein and total nitrogen content. The sequence was - Cu + Fe: K-850 > BG-256 > PG-114; Fe + Zn: BG-256 > K-850 > PG-114; Cu + Fe + Zn + Mn + B: PG-114 > K-850 > BG-256. Among the three cultivars, decrease in var. K-850; was maximum with Cu + B followed by BG-256 and PG-114 whereas, Zn + Mn caused maximum decrease in var. BG-256 followed by PG-114 and K-850. The relative tolerance of the cultivars against each combination is one of the important causative factor affecting the nitrogen metabolism and protein synthesis that had also been reported by Singh and Khan (1994) and Bharti *et al*., (2002).

Therefore, it is desirable to select such a combination, which may enhance the metabolic concentration and elemental bioaccumulation in the seeds without causing any toxicity and must be in accordance with cultivar requirement under the prevailing status of the elements in the soil to eliminate deficiency or excessive availability.

This study is helpful for agriculturists/farmers to understand the importance of various combinations of micronutrients on different cultivars of chickpea. It is also inferred that these types of studies are helpful in increasing the productivity and yield for a variety of crops and the role of micronutrients in growth and overall development regarding nutritional quality of various economically important crops for humans (Bhuiyan *et al.*, 1999).

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